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EXAMINER	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/634,543	Applicant(s) DAROLIA ET AL.	
	Examiner Marianne L. Padgett	Art Unit 1762	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *8/5/2003 & 12/6/2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-30* is/are pending in the application.

4a) Of the above claim(s) *21-30* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *8/5/3, 12/6/4*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:

I. Claims 1-20, drawn to a method for improving corrosion resistance, classified in class 427, subclass 523.

II. Claims 21-30, drawn to a turbine engine rotor component, classified in class 428, subclass 632.

2. The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case, the product may be made by a materially different process. While it is noted that certain claims are product-by-process and incorporate the same process steps as described in Group II, a product defined by the process by which is can be made, is still a product claim (*In re Bridgeford*, 149 USPQ 55 (CCPA 1966)) and can be restricted from the process if the examiner can demonstrate that the product as claimed can be made by another materially different process such as the alternative process described above (*In re Brown*, 173 USPQ 685, *In re Fessman*, 180 USPQ 324). The product may be made by vapor deposition, sputtering, or spray to produce structures equivalent to those produced by ion implantation processes (encompasses many variations).

3. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

Because these inventions are independent or distinct for the reasons given above and there would be a serious burden on the examiner if restriction is not required because the inventions have acquired a

separate status in the art due to their recognized divergent subject matter, restriction for examination purposes as indicated is proper.

Because these inventions are independent or distinct for the reasons given above and there would be a serious burden on the examiner if restriction is not required because the inventions require a different field of search (see MPEP § 808.02), restriction for examination purposes as indicated is proper.

4. During a telephone conversation with Don Hasse on April 22, 2005 a provisional election was made with traverse to prosecute the invention of Group I, method claims 1-20. Affirmation of this election must be made by applicant in replying to this Office action. Claims 21-30 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

5. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

6. Claims 1-20 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claims 1 & 4, the limitation of "<u>implanting</u>... ions... <u>on</u> the surface of the component" (emphasis added) is contradictory or ambiguous phrasing, because by definition "implanting" requires penetration of the surface, such that the ions are injected **into** or **in** the surface, hence are not *per se* **<u>on</u>** the surface. Note that claim 5 may also be said to have this ambiguity in that it claims "the ions are implanted to a depth **<u>up to</u>** about 2 microns" (emphasis added), as the range limit of "up to" is inclusive of zero, i.e. on the surface. Independent claims 14, which employs the same language as claim 5, may also

be considered ambiguous, since the "implanting..." step includes the depth of zero, which would not be implanting.

The scope of claim 14 is also uncertain or unclear, because the preamble is directed to "a turbine engine rotor component", while the body of the claim is not commensurate in scope, being broader of scope, since step (a) claims "providing a rotor component selected from the group consisting of compressor and turbine disks and seal elements", which thus includes any compressors & seal elements from all rotor apparatus, not just those in turbine engines. In other words, the preamble is not commensurate in scope with the body of the claims, as the "a rotor component" referred to in the body does not have antecedent basis to the narrower scope referred to in the preamble. Applicants are also directed to their disclosure in the specification in paragraph [0027], where the specifically designated components of the turbine engine rotor are said to include "compressor disks, seals, and shafts", such that it is noted that the disks disclosed therein are **turbine compressor disks**, which is different in scope from what is claimed in independent claim 14. Figure 1, discussed in [0022], shows turbine engine rotor component structure is inclusive of turbine disks & turbine seal elements. At the beginning of the specification [0001] relates the invention only to a "turbine engine component" that is exemplary described as "compressor or turbine disk, seal elements or shaft", with [0002-3] providing further discussion on the use of these components in gas turbine engines

The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d)(1) and MPEP § 608.01(o). Correction of the following is required: while claim 14's scope may be considered ambiguous, **as presently written** the body of the claim appears to include broader scope concerning implantation & heating of non-turbine engine rotor components and is disclosed by the body of the specification (see discussion immediately above).

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or

claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

8. Claims 1 & 4 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Murakami et al. (JP 62-174377, also Ono Shuji; formal translation ordered, not yet received, Japanese patent document supplied by examiner).

Claim 2 is rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Murakami et al., optionally considering Naik (4,919,773) or Bedell et al. (GB 2241961 A) or Manty et al. (4,433,005) as teaching references.

Murakami et al., as presented by the abstracts supplied by applicants teach ion implanting turbine vanes (i.e. blades of a rotor) with from 1-3 ions selected elements inclusive of Cr, Si, Y, Al, Zr, etc., successively implanted into the surface of the composite material and turbine vane, in order to create an erosion & corrosion resistant surface, with a specific example of implanting Cr presented.

Murakami et al. is directed to treatment of turbine vane, which term inherently encompasses the claimed "turbine engine rotor component", however as presented in the abstract that there is no teaching concerning the rotor component being "a compressor or a turbine disk or a seal element", but the turbine engine may be considered to inherently encompass the option of "a compressor" ≡ compressor component, as is evident from the teaching references of Naik (4,919,773; col. 1, lines 14-30 & col. 2, lines 41-45 teaching gas turbine engine compressor blades & gas turbine compressor components) or Bedell et al. (GB 2241961 A: abstract & page 1, lines 1-7, compressor blade for a gas turbine aero engine or gas turbine compressor or blades) or Manty et al. (4,433,005: col. 1, lines 50-51 & col. 2, lines 3-6 & 18-22, gas turbine compressor environments & gas turbine [titanium] compressor blades), which references appear to demonstrate that the turbine engine or the turbine as referred to in Murakami et al. is itself a compressor, hence the vane treated therein is a compressor blade, i.e. a compressor component.

Alternately, as these terms are so typically used interchangeably the reference in Murakami to treating turbine vanes would have suggested to one of ordinary skill in the art to treat turbine compressor blades, as they may be considered equivalently.

9. Claims 1 & 7-8 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Dodd et al. ("The effects of ion implantation on the fatigue life and corrosion resistance of M50 steel bearings").

Claim 2 is rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Dodd et al., optionally considering Naik (4,919,773) or Bedell et al. (GB 2241961 A) or Manty et al. (4,433,005) as teaching references, for reasons as set forth above, further noting that if a gas turbine is equivalently a gas turbine compressor, then any component there of is a compressor component.

Claims 5-6 & 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dodd et al.

Dodd et al. teach ion implanting Cr into bearings or main shaft bearings of aircraft gas turbine engines (i.e. components of turbine engine rotors), so as to increase the service/fatigue life and corrosion resistance thereof (abstract). Page 755 discuss tests employing two different Cr ion doses (1.0×10^{17} & 2.0×10^{17} ion/cm^2) & various ion implantation parameters (200 kV, 1.15 mA, power density of 0.13 W/cm^2, pressure $<2.0 \times 10^{-4}$ Pa, substrate rotation & ions impinging at 45°), including that the temperature during implantation was kept below 250°C. Further test results are discussed on page 756-7, including corrosion prevention effects.

Dodd et al. does not teach the depth of implantation into their metallic surface, however it would've been obvious to one of ordinary skill in the art to limit the depth to the minimum necessary to sufficiently provide surface protection without affecting structural integrity, which would have been expected to be a relatively thin surfaces effect, such as the ranges claimed (~0-2 μ or ~0.1-0.5 μ).

10. Claims 3 & 5-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Murakami et al., optionally in view of Dodd et al. and/or Baty et al. (EP 0240110 A1).

While Murakami et al. does not specify the service operating temperature of their treated turbine component, the operating temperature would have been dependent on the particular enduse of the specific turbine, and while turbines in general may be considered to be used in high energy environments, particular turbines will be operated in different ranges dependent on enduse, which may be inclusive of the claimed temperature range, especially considering that the materials discussed in Murakami et al., which as treated would have been expected to be effective in the claimed temperature range.

The English abstracts do not provide teachings on the temperature is employed during the ion implantation process (p.3, top left quarter recites 100°C, but translation awaited to determine the context), however it would've been obvious to one of ordinary skill in the art to employ routine experimentation to determine effective temperatures per for producing the taught affect via the taught ion implantation process, where significant heating would not be expected to have been necessary because the energy for implantation is supplied via the acceleration of the ions (the Japanese text also has potential implications of low temperatures). Alternately, Dodd et al., who is ion implanting Cr at 200 kV for analogous corrosion prevention properties, which overlaps with ions & doses taught by Murakami et al., as well as reasonably corresponding to the 50-500 KeV implantation energy/acceleration, teaches limiting temperature during implantation, hence it would've been further obvious to one of ordinary skill in the art to consider the parameter teachings of Dodd et al. when optimizing the parameters for Murakami et al.'s process via routine experimentation by employing parameters taught therein, such as implantation temperature limits as a reasonable starting point for optimization of a particular ion implantation process. Or similarly, Baty et al. (abstract; p. 6-8; table, p.10; figures especially 2-4), who is also employing Cr ion implantation at energies of 75KeV & doses of about 7.0×10^{16}-1.5×10^{17} ion/cm^2 to improve corrosion resistance of metal alloys such as zirconium, in the particular example on page 6, teaches that heating during implantation is estimated to be in the range of 93-204°C, thus for like parameters used for implanting Cr ion as are taught by Murakami et al., it would've been obvious to one of ordinary skill in

the art that a similar amount of heating would occur, thus providing expectation of implantation temperatures as claimed.

Murakami et al. does not teach the depth of implantation into their metallic surface, however it would've been obvious to one of ordinary skill in the art to limit the depth to the minimum necessary to sufficiently provide surface protection without affecting structural integrity, which would have been expected to be a relatively thin surfaces affect such as the ranges claimed (~0-2 μ or ~0.1-0.5 μ). Alternately, Baty et al., who is employing overlapping doses & energy (75 KeV) of chromium ions provides data on depth of implantation for relevant parameters, which as illustrated in figures 2-4 have peak concentrations between depths of 400-500 Angstroms (i.e. 40-50 nm = 0.04-0.05 μ) with maximum depth shown to be around 1200 Angstroms = 120 nm = 0.12 μ with some variation for different doses, hence providing expected values for the lower energy ranges taught in Murakami et al. (dependent on dose), where one of ordinary skill in the art would have expected a higher taught energies of (maximum 500 KeV) to encompass greater depths of penetration, dependent on particular metallic surface being implanted, as well as dose.

11. Claims 10-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Murakami et al. or Dodd et al., as applied to claims 1-2 & 3-9, or 1 & 5-9, respectively above, and further in view of Baty et al. (EP).

The primary references of Murakami et al. or Dodd et al. do not discuss a post-treatment heating process in non-oxidizing atmospheres, with temperature ranges of about 500-800°C or 600-700°C to effect diffusion of implanted ions, however Baty et al. includes teachings of a post-treatment stress relief annealing in vacuum at 510°C (950°F) for two hours (page 6, lines 24-30; page 10, table specimens #2, 4 & 6), where while dependent on dose employed, was seen to be a useful technique in optimizing corrosion protection effects, hence it would have been obvious to one of ordinary skill in the art to employ analogous annealing techniques for the ion implantation corrosion protection treatments of the

primary references in order to improve & optimize the corrosion protection, where one of ordinary skill would employ routine experimentation considering the annealing parameters of Baty et al. to optimize for corrosion protection dependent on specific metallic substrates, specific ions & doses, etc., which would have been expected to encompass temperatures in claimed ranges given that the exemplary temperature from Baty et al. is within the broad range. It is noted that this heating process would inherently affect a certain degree of diffusion of the implanted ions in the metallic surface.

12. Claims 1 & 4 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Schaeffer et al. (5,780,110).

Claim 2 is rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Schaefer et al. (110), optionally considering Naik (4,919,773) or Bedell et al. (GB 2241961 A) or Manty et al. (4,433,005) as teaching references, as discussed above in section 8.

Claims 2-3 & 5-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schaeffer et al. (110).

Schaeffer et al. (5,780,110) teach a coating system for gas turbine engine metallic components generally, or blades & vanes, specifically, where a superalloy substrate, which is the component may have a bond coating that is treated by pre-oxidation and/or surface doping so as to promote adhesion between the interface of the bond coating & thermal barrier coat (TBC). The surface doping may be performed via ion implantation of elements that oxidized faster than Al, such as exemplified Cr or Y, in order to form oxides of the same crystal structure as α-Al_2O_3. The "preoxidation" step is suggested to be performed in oxygen rich atmospheres at temperatures >1000°C for times >1 hr after depositing the bond coating, but before deposition of the TBC to heal cracks or pores in the bond coating & thermodynamically stabilize the low atomic volume α-Al_2O_3 phase. See the abstract; figures; col. 1, lines 10-63 (background); summary; col. 2, lines

47-col. 3, lines 64 general structure & deposition techniques and col. 4, lines 41-col. 5, lines for, especially col. 4, lines 47-57 & 66-col. 5, line 4; and claims, particularly 1& 2.

While Schaeffer does not teach implantation depth, note that the α-Al_2O_3 interface layer, reference #28, as shown in figure 2 is taught to have a thickness of 0.01-0.25 mils (col. 4, lines 35-38) = about 0.25-6.4 μ, hence as the interface may be formed by surface doping one of ordinary skill in the art would conclude that appropriate implantation depths in the bond coating would have been on the order of the thickness of the formed interface layer thus suggestive of the claimed implantation depths of up to 2 μ or about 0.1-0.5 μ, which encompass the interface thickness.

Schaeffer does not teach the specific rotor components of compressor, turbine disk or seal element, however note above discussion concerning compressors, or alternately note turbine components in general are suggested such that it would've been obvious to one of ordinary skill in the art to provide taught protective coating system, which is specifically designed to protect metallic components from high-temperature corrosion & oxidation problems via thin hard adherent layers, thus it would've been obvious to one of ordinary skill in the art to employ such techniques to any susceptible metallic rotor components subject to oxidative and corrosive atmospheres, which would have been expected to be inclusive of claimed service operating temperatures and claimed specific rotor components.

When discussing their ion implantation process, Schaeffer et al. do not discuss the temperature under which implantation occurs, however as discussed above one of ordinary skill incompetence would have been expected to employ routine experimentation to determine the appropriate temperature in which to affect taught ion implantation procedures for specific metallic substrate components, where the majority of the process energy would have been expected by one of ordinary skill to have been supplied by the ion bombardment itself.

13. Claims 2 & 12-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Murakami et al., as applied to claims 1-2 & 3-9 above, and further in view of Schaeffer et al. (5,780,110, discussed immediately above) or Hayashi et al. (JP 02-015164, also Hida Shuji; formal translation ordered, not yet received, English abstract supplied by applicant & Japanese patent documents supplied by examiner), and optionally further view of Weimer et al. (6,532,657 B1) or above teaching references as set forth in section 8 above.

Murakami et al. does not teach the specific turbine/rotor component that is a seal element, a turbine disk, or a compressor, nor does Murakami et al. teach a posttreatment heating step in the presence of oxygen, where temperature ranges of about 450-800°C, or 600-700°C. are employed, to effect oxide thicknesses of about 0.5-3 microns. However, Hayashi et al. (English abstract) teaches ion implanting a base metal, such as Ti or Ti alloy, with Pt & Al ions, where the implanted substrate is exposed to high temperature oxidizing atmosphere to diffuse Al, so as to result in incorporation of sufficient amounts of Al & Al_2O_3 to thus contribute to the oxidation protective film, i.e. high-temperature oxidation resistance ≡ corrosion resistance. Alternately, Schaeffer et al. (110) teach coating system for gas turbine engine metallic components to provide a protective coating against oxidation in corrosion that includes on an implanting techniques that may be combined with oxidative annealing techniques to provide both superior oxidation/corrosion resistance, as well as improved adherence, hence it would've been alternatively obvious to one of ordinary skill to employ such oxidative annealing with the implanted ions, especially where such implanted ions are desired to be oxidized in order to affect the oxidative protection as taught by Schaeffer et al., and where one of ordinary skill in the art would have been expected to apply routine experimentation to determine appropriate annealing temperatures dependent on the specific composition of the substrate surface that has been implanted so as to most expeditiously & economically optimize the corrosion protection.

It is further noted that while none of these references specifically refer to rotor components that are compressors or turbine disks or seal elements to be ion implanted for protector purposes, either secondary reference teaches the generic usefulness of these techniques, such that as discussed above it would've been obvious to one of ordinary skill in the art to employ such techniques on any of the specific components of the rotor/turbines which would have been expected to be exposed to hostile & corrosive environments at any time during their use or lifetime. Optionally, Weimer et al. (6,532,657 B1) teaches the need to protect gas turbine components, such as turbine disks, rotating seals, stationary shrouds, etc., which are said to be particularly subject to corrosion & oxidation damage due to combination of heat and corrosive/oxidative effects of contaminants in the bleed gas cooling (abstract; col. 1, lines 4-35; col. 2, lines 21-29; col. 3, lines 50-col. 4, lines 15+), where the protective coating procedure is perfectly taught to include oxidized coating including elements such as Al, Cr, Si or mixtures thereof, with teachings of oxidative steps in air that include substrate heating from about 1200°F-1550°F for at least two hours. Therefore, Weimer et al. (657) is support in the of the above contention that compressor, disk & seal element rotor components of turbine engines would also need protective coatings where the above discussed coatings with oxidized portions would have been expected to be effective for these particular components also.

Note that while Weimer et al. (657) was published within a year of the present filing date, it is to it different inventive entity with only overlapping inventors.

14. Claims 1 & 4-6 are rejected under 35 U.S.C. 102(e) as being clearly anticipated by Darolia et al. (6,617,049 B2 or 6,632,480 B2) or Rigney et al. (6,620,525 B1).

Claims 2-3 & 6-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Darolia et al. (6,617,049 B2 or 6,632,480 B2) or Rigney et al. (6,620,525 B1), optionally view of Weimer et al. (6,532,657 B1) as discussed in section 13 about or optional teaching references as set forth in section 8.

First it is noted that these references have filing dates predating that of the present case, and while they have overlapping inventors with the present case, the inventive entity is different, hence unless shown to be assigned to /owned by the same assignee **at the time** of the invention, these patents are prior art.

Darolia et al. (049) is teaching a thermal barrier coating (TBC) system, which is erosion & impact resistant, for components intended to be used in hostile environments, such as nozzles, blades, shrouds, combustor and augmentor components of a gas turbine engine, where taught processes for depositing the columnar TBC coating include various physical vapor deposition processes, where one alternative method uses an ion beam source of aluminum (a cathodic arc source), while evaporating yttrium stabilize zirconium (YSZ) to create a dispersion of alumina particles in the protective YSZ coating (abstract; figures, especially 2, and reference #32 = alumina particulates, #30 = individual columnar grains, #26 = TBC; col. 3, lines 9-30 & 59-67+, especially 25-27; col. 5, lines 35-63, especially 61-63). Note that for this technique, the ion beam employed during the vapor deposition process will inherently be implanting the ions in the coating material to produce the embedded alumina particles, hence this is occurring on the surface of the component as claimed, such that the depth is inclusive of the "up to" = 0 depth limitation when considered with respect to the component surface, however the ions are also being implanted to a depth in the deposit as it is being made, where this depth in the deposit coating may be considered encompassed by the claimed depths (up to about 2 μ, or about 0.1-0.5 μ), since in no case in the claims is it specified in what the depth of implantation occurs & since the TBC is deposited on the surface with the ions of the ion beam are forming alumina particulates in the coating, the depth could reasonably be said to refer to the depth in the coating, which is on the surface. The TBC is taught to have a thickness on the order of about 75-300 μm, while alumina particles may have diameters ranging from about 100-500 nm = 0.1-0.5 μm, hence considering the claimed depth to be in the coating as it is being deposited, it would appear to inherently encompass the claimed depth range considering taught dimensions and

configurations. Alternately, it would've been obvious to one of ordinary skill in the art given both the dimensional and configurational teachings to employ parameters so as to produce these taught physical considerations, which would have been expected to be effective with energies which would produce penetration depths in the deposit as claimed, so as to produce the oxide particulates from the ions as a part of the TBC layer Also note that use of the taught ion beam with evaporated yttrium & zirconium will inherently ionize some of the Y & Zr been deposited. With respect to temperatures employed during the physical deposition process using the ion beam, as no specific process parameters are given, one of ordinary skill in the art would have been expected to employed routine experimentation to determine effective process parameters, particularly the temperature at which the ion beam assisted physical deposition process is done in order to produce the columnar TBC structure with alumina particulates, which reasonably would've been expected to be inclusive of temperatures in the claimed range, especially as such PVD processes with beam assistance to provide additional energy, generally do not require use of high additional heating.

Darolia et al. (480) has analogous teachings to Darolia et al. (049), thus covering analogous subject matter with analogous obviousness. In Darolia et al. (for a go see the abstract; figures; summary; column 2, lines 45-61; column 5, lines 33-column 6, lines 16; and claims 1-2, 4-59-13 & 17-19.

Rigney et al. (525) has analogous teachings to Darolia et al. (049), thus covering analogous subject matter with analogous obviousness. In Rigney et al. (525), see the abstract; figures, especially to & reference #26, 32, 34 & 36; col. 1, lines 7-14 & 38- 60, especially 50-55; col. 2, lines 41-60+; col. 3, lines 4-44 & 57-67, especially 24-29 (ion beam of Al &/or Cr); col. 4, lines 51-67; col. 5, lines 28-col. 6, lines 49, especially col. 6, lines 15-18 & 48.

15. Claims 1, 3 & 4-5 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Rigney et al. (6,283,714 B1).

Claims 2 & 6-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over or Rigney et al. (714), optionally view of Weimer et al. (6,532,657 B1) as discussed in section 13 above, or optional teaching references as set forth in section 8.

Rigney et al. (714) teaches applying external protective coatings (bond + ceramic coating or environmental coating) onto gas turbine airfoils where operating temperatures may be **up to** 1900-2100°F (i.e. a component of claimed rotors) via physical vapor deposition (PVD) processes that are inclusive of ion plasma deposition or cathodic arc deposition, as well as plasma spraying or sputtering processes, which also may involve depositions involving ionize material. External surfaces are coated with a protective overlay that may be MCrAlX alloy, where M = Ni, Co, Fe & X = Hf, Zr, Y, Si, etc., which may then optionally have a ceramic coating of, for example yttrium-stabilize zirconia deposited thereover via taught PVD processes, such as ion plasma deposition or cathodic arc, also deposited via taught PVD techniques (abstract; figures; col. 1, lines 5-30; col. 3, line 6-15; col. 4, lines 25-43; col. 5, lines 7-53; and col. 7, lines 38-60). It is noted that since the ions of the claimed "implanting" limitations are claimed to be "on the surface of the component" where the depth may be zero, that any of the deposition techniques of Rigney et al. (714), which employ ions, such as the ion plasma deposition or the cathodic arc & probably the sputtering process, may be considered to read on these claims as ambiguously written, as the ions of these deposition processes are necessarily being deposited on the surface as claimed. Alternatively, it is old and well-known to those of ordinary skill in the art that such ionized & plasma processes frequently employed substrate biasing, especially for metallic/conducted substrates as treated in Rigney et al. (714), where such biasing is desirable as it induces ion bombardment from the plasma that can be optimized to affect sufficient ion implantation to cause ion mixing at the interface, thus improving adherence of the ion plasma deposited or cathodic arc deposited, or the like layer, which is desirable to provide where resistance with respect to particle impacts & oxidation/corrosion resistance in the hot combustion gas environment of a gas turbine.

While Rigney et al. (714) does not specifically discuss ionized deposition on any surfaces except internal & external surfaces of gas turbine airfoils, in their background they also mention other parts of the gas turbine engine, such as shafts, compressor, turbine disks, as well as blades and vanes (col. 1, lines 5-35 & col. 4, lines 25-43), hence for reasons as discussed above it would've been obvious to one of ordinary skill in the art to also provide such protective coatings to surfaces of other turbine components which are also exposed to harsh environments found therein. Also as discussed above, optimization of process temperature in which the ions are employed with have been expected to have been determined for taught processing of specifically named PVD processes via routine experimentation dependent on particular materials & other energy considerations, such as ion acceleration energy that would depend on if biasing is employed & voltages used, etc.

16. Claims 1-5 & 7 are ejected under 35 U.S.C. 102(e) as being anticipated by Zhao et al. (6,964,791 B2). Note effective filing date is before the filing date of the present case, and this patent is to the same assignee, but all different inventors.

Claims 6 & 8-9 rejected under 35 U.S.C. 103(a) as being unpatentable over Zhao et al. (791). In Zhao et al. (791), see the abstract, col. 2, lines 43-col. 3, lines 20+ & 47-55; col. 4, lines 3-67; col. 5, lines 7-60; claims & below discussion of teachings therein.

Claims 1-9 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-29 U.S. Patent No. 6,964,791 B2 (Zhao et al.). Although the conflicting claims are not identical, they are not patentably distinct from each other because the claims are overlapping scope, with limitations presented in different orders, and the patent claims requiring coating steps that are neither required nor excluded by the present claims. The independent claims of the patent require specific metal superalloy substrate material, while the present claims are generic or required no specific composition for the component treated. On the other hand, the patent independent claims are generic as to the article that is to be used in a "high-temperature oxidative environment", with only

dependent claims 11 & 12 directed to a component for a gas turbine assembly, or specifically a turbine airfoil, a turbine disk or combustor, respectively, while the instant independent claim 1 requires a turbine engine rotor component, with the dependent claim 2 directed to specific rotor components of a compressor or turbine disk or seal element.

The patent claims are directed to depositing to coating layers both of which must contain Al, and where the first layer must also contain Zr & may also include Hf, Y, Si &/or Ce, were the physical deposition technique of ion plasma deposition may be employed for both players, and where the two layers may be reacted/process so as to effect an Al composition gradient the heating, that may be *in situ* during deposition. Above discussion concerning present claim language problems with respect to "implanting", "on the surface..." & "a depth up to...", whose location is also not specified, are also relevant here providing overlapping & obvious relationships with the patent claim language, for the ion implanting of Al, Cr, Y, Ce, Zr, Cr, Hf & Si ions of the ion plasma deposition limitations. Furthermore, the patent claims use of ion plasma deposition & in situ heat-treating during deposition is considered to read on ion implanting into the preceding layer in light of the specification, which discusses reacting by heat treating on col. 4, lines 42-col. 5, line 6, with *in situ* heating during deposition col. 4, lines 52-67, teaching diffusing the Al of the second layer into the first layer, in particular specifying that the *in situ* heating may be achieved by applying a bias voltage to the substrate during the ion plasma deposition of the second layer. While not explicitly discussed in the section of the patent, the examiner takes notice that the use of bias voltage in the ion plasma deposition with both create the heating effect due to ion bombardment & provide the Al ions of the plasma with the energy to both deposit on the surface and implant into the surface, thus creating some degree of ion implantation in order to the effect the taught diffusion, thus reading on & encompassing the ion implanting of aluminum in the present claims. Note above discussed arguments for the obviousness of claimed ranges of depth of implantation when considering depth with respect to current and currently deposited coating are also relevant here. While

the patent claims do not have a particular claimed temperature range for the heat treating process, one of ordinary skill in the art would determine such via routine experimentation, where analogous to previous discussion above of heating due to ion bombardment/implantation, it is noted that the ion treatment provides alternative energy source, such that the absolute amount of heat required to provide the desired effect, in this case producing the aluminum gradient, would have been expected to be less than if merely heat input, particularly after deposition was involved. Again in light of the specification, it is noted that post-treatment heating alternative to provide the same gradient effects is taught on col. 4, lines 45-52 require about 700-1200°C, where the 700°C endpoint is noted to overlap with the claimed ion implantation temperature range, hence it would've been obvious to one of ordinary skill to consider these temperatures or lower for effecting the claimed & taught in situ heat treatment during ion plasma deposition, such that considering the non-heat energy component of the bombarding ions would have been expected to make effective the lower temperature ranges as claimed presently by applicants.

17. Other art to the same assignee/overlapping inventors includes Darolia (6,273,678 B1: col. 7, lines 60-col. 8, lines 18) or 7,087,266 B2: abstract; figures; col. 5, lines 1-9; col. 10, lines 1-8 & claims), which have teachings substantially similar/analogous to Rigney et al. (714) or Darolia et al.((049) or(480)), except they are a bit more general; and Zhao et al. (6,720,088 B2) & Darolia et al. (6,436,473 B2) which are directed to protective coatings for relevant and garments & articles, but lacked teachings of techniques with appropriate use of ions.

Other art of interest relevant to the invention include: Fujishiro et al. (4,137,370) & Eylon et al. (5,879,760), which along with Manty et al. ((005) mentioned above) discussing various surface treating techniques involving ion implantation &/or ion plating for providing fatigue &/or oxidation resistant coatings to relevant substrates, but while some of the treatments involve Al &/or Cr, they do not appear to be necessarily ion implanting, although there is background discussion (Manty et al., col. 1, lines 35-51, or also found in Bedell et al.(GB): p.1, line 25-p.2, line 3) concerning ion implantation with metals (i.e.

Ce, Y, Al, etc.) of Ti substrates to protect against/inhibit thermal oxidation, but its effectiveness in gas turbine compressor environments was not discussed. Beers et al. (5,580,669) is it of interest for oxidative resistant coatings for Ti alloys, such as used in **gas turbine engine compressor blades, vanes & related hardware**, where depositions employing ion vapor deposition or cathodic arc deposition of Cu alloys inclusive of Al &/or Si constituents are disclosed, for making components useful in claimed temperature ranges, but lacks disclosure concerning whether or not any ion implantation occurs. Paderov et al. (6,797,335 B1), who is also effecting treatments for high resistance to wear & corrosion with sufficient fatigue strength, primarily for **gas turbine compressor blades & vanes**, employs ion implantation with their deposition techniques, however uses nonmetallic ions. Lankford Jr. (4,775,548) has teachings for ion implantation processes of metal ions (i.e. Y, Zr, Zn, Ag, Nb, Ti, etc.), followed by oxidation in air at 600-800°C in ceramic compositions for low friction, high wear resistance at high operating temperatures in "adiabatic diesel engines" (appear to use pistons not rotors), and White (3,857,682) teaches a surface treatment of seal & bearing surfaces for use in high temperature environments, with mention of jet turbine heat engines & components of materials, such as steel, Al or Ti, with exemplary Al bodies ion plated with Cr, thus White provides cumulative evidence of the importance of treating seal surfaces.

18. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Marianne L. Padgett whose telephone number is (571) 272-1425. The examiner can normally be reached on M-F from about 8:30 a.m. to 4:30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks, can be reached at (571) 272-1423. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

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MLP/dictation software

4/18/2007 & 4/23-25/2007

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